

The Genus *Gabbioceras* (Ammonoidea, Gaudryceratidae) from the Upper Cretaceous of Hokkaido, Japan

By

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Abstract Two species of *Gabbioceras* HYATT, 1900 (Ammonoidea, Gaudryceratidae), *Gabbioceras yezoense* sp. nov. and *G. mikasaense* sp. nov. are described from the Upper Cretaceous of Hokkaido, northern Japan. *G. yezoense* sp. nov. occurs in the lower part of the lower Cenomanian. *G. mikasaense* sp. nov. occurs in the lower to the middle part of the lower Cenomanian and represents a younger member of the *Gabbioceras* lineage. Although *Gabbioceras* experienced a distinct decline from the late Albian and became extinct in the Mediterranean Tethyan realm, the occurrences reported here suggest that a few species of *Gabbioceras* survived and evolved in the Northwest Pacific region during the early Cenomanian.

Introduction

The genus *Gabbioceras* HYATT, 1900 of the family Gaudryceratidae is characterized by having a round venter and depressed whorls with a strong angulation on the flank at some growth stage. This genus has been considered to be an offshoot of *Eogaudryceras* SPATH, 1927 (WIEDMANN, 1962); *Gabbioceras lamberti* (BREISTROFFER), 1936 is the oldest species within the genus (KENNEDY & KLINGER, 1977). During Aptian and Albian time *Gabbioceras* evolved and radiated in the Tethyan realm. However, this genus declined in diversity in the Cenomanian, and only one species is known from the lower Cenomanian of Madagascar (COLLIGNON, 1964; MURPHY, 1967a, 1967b; KENNEDY & KLINGER, 1977).

Gaudryceratid ammonites occur fairly abundantly in the Upper Cretaceous of Japan and have been described in many papers (e.g., JIMBO, 1894; YABE, 1903; MATSUMOTO, 1938; MATSUMOTO, 1995). Nevertheless, no species of *Gabbioceras* has hitherto been reported. Recently, I have collected some well preserved specimens referable to *Gabbioceras* from the lower Cenomanian of Hokkaido assisted by friends of mine. In this paper, I describe two new species of the genus and discuss the phylogenetic and paleobiogeographic implications.

Systematic Description

Location of specimens: The specimens utilized herein are deposited in the National Science Museum, Tokyo (NSM), the University Museum, University of Tokyo (UMUT) and the Mikasa City Museum, Mikasa (MCM).

Conventions: Dimensions are given in millimeters: D=shell diameter, U= breadth of umbilicus, H= whorl height, B= whorl breadth.

Order Ammonoidea ZITTEL, 1884

Suborder Lytoceratina HYATT, 1889

Superfamily Tetragonitaceae HYATT, 1900

Family Gaudryceratidae SPATH, 1927

Genus *Gabbioceras* HYATT, 1900

Type species: *Gabbioceras angulatum* ANDERSON, 1902.

Diagnosis: Very involute gaudryceratids with a small umbilicus, a round venter and a depressed whorl with an angulation on the flank at some growth stage. Shell surface ornamented with growth lines and constrictions which are prorsiradiate on the flanks and form either an adorally convex arch or are almost straight on the venter. Suture is similar to that of early gaudryceratid-type, in having a bifid first lateral saddle.

Discussion: MATSUMOTO (1943) established the genus *Parajaubertella* but WIEDMANN (1962) considered the genus as a synonym of *Gabbioceras*. However, MURPHY (1967a), JONES (1967) and MATSUMOTO (1995) pointed out that both genera can be clearly distinguished by the differences in the shape of the umbilicus, suture line and other characters, and I also agree with their view.

Occurrence: Aptian of southern France, Majorca and North Africa, Albian of southern France, Madagascar and California, and early Cenomanian of Madagascar and Hokkaido.

Gabbioceras yezoense sp. nov.

Figs. 1-1, 2-1, 2, 7

Diagnosis: Small *Gabbioceras* having a very depressed whorl, broadly arched venter, funnel-shaped deep umbilicus, angulation on flank, gently convex umbilical wall, subangular umbilical shoulder, and shell surface of fine growth lines and constrictions, which are almost straight on venter.

Dimensions: See Table 1. Initial chamber size, ammonitella size and its spiral length in specimen UMUT MM18958 in median section are 0.522 mm, 0.903 mm, and 298° respectively.

Description : The largest specimen (NSM PM8299), 15.3 mm in diameter at the preserved last septum, consists of the phragmocone and a part of the body chamber. The entire shell would be less than 30 mm in diameter. The shell is very involute, with a fairly narrow and funnel-shaped deep umbilicus separated from the venter by an angulation in the shell wall. The whorl cross section (Fig. 2-7) is depressed reniform with a broadly arched venter, a gently convex umbilical wall, and subangular umbilical shoulder. The angulation is at a position about one third the height from the umbilical seam to the venter. The shell surface is ornamented with constrictions and growth lines, which are almost straight on the venter. The ornamentation near the umbilical shoulder is sometimes conspicuous. The suture is similar to that of the gaudryceratid-type in having a bifid first lateral saddle (Fig. 1-1).

Comparison : *Gabbioceras yezoense* sp. nov. closely resembles *Gabbioceras michelianum* (d'ORBIGNY, 1850, p. 124) from the middle Albian of France but is distinguished from the latter in having a narrow umbilicus, a gently convex umbilical wall, and subangular umbilical shoulder. *Gabbioceras yezoense* sp. nov. also resembles *Gabbioceras* aff. *michelianum* (MURPHY, 1967a, pl. 4, figs. 6, 7)

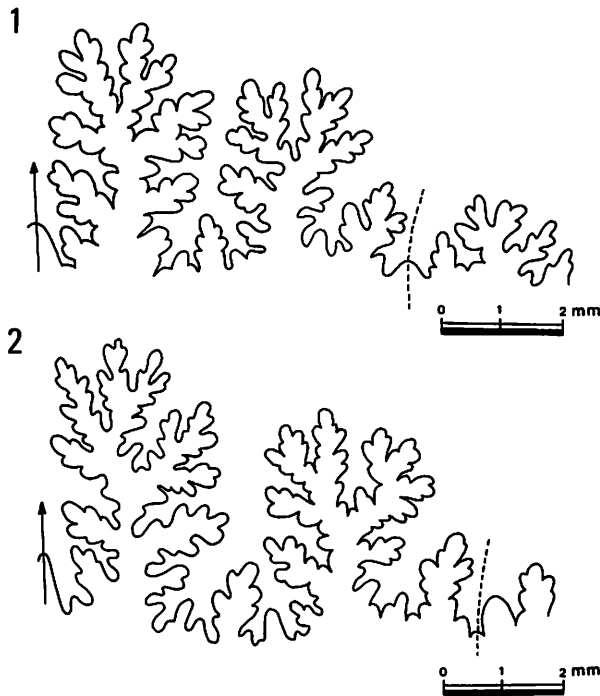


Fig. 1. External suture lines of: 1, *Gabbioceras yezoense* sp. nov., NSM PM8300, locality 4, at whorl height of 5.0 mm; 2, *Gabbioceras mikasaense* sp. nov., MCM. A399, locality 2, at whorl height of 5.6 mm. Broken line: position of the umbilical shoulder.

Table 1. Measurements (in mm) of *Gabbioceras yezoense* sp. nov.
at the preserved last septum.

Specimen	D	U	H	B	U/D	B/H
NSM PM8300	15.3	3.9	6.3	15.6	0.25	2.48
NSM PM8299	13.0	3.4	5.0	12.1	0.26	2.42

from the lower Albian of California in having a narrow umbilicus but is distinguished from the latter in having constrictions and a subangular umbilical shoulder.

Etymology: This species is named for the Yezo Supergroup.

Material: Holotype, NSM PM8300; paratypes, NSM PM8299, UMUT MM18958.

Type locality: Locality 4.

Occurrence: Lower part of the lower Cenomanian; localities 4, 5, 6.

Gabbioceras mikasaense sp. nov.

Figs. 1-2, 2-3, 4, 5, 6, 8

Diagnosis: Small *Gabbioceras* having a depressed whorl, rounded venter, funnel-shaped deep umbilicus, gently convex umbilical wall, subangular umbilical shoulder, and shell surface of fine growth lines, which are almost straight on the venter.

Dimensions: See Table 2. Initial chamber size, ammonitella size and its spiral length in specimen MCM. A401 in median section are 0.696 mm, 1.286 mm, and 340° respectively.

Description: The shell is rather small, less than 35 mm in diameter, and very involute, with a fairly narrow and a funnel-shaped deep umbilicus. The cross section of the early whorls (Fig. 2-8) is depressed reniform with a weakly developed angulation at the mid-flank of the whorl, and that of the later whorl is relatively more depressed reniform with a rounded venter, gently convex umbilical wall, and a subangular umbilical shoulder, which is at a position about one fourth to one fifth the height from the umbilical seam to the venter. The shell surface is ornamented with growth lines, which are almost straight on the venter. The ornamentation near the umbilical shoulder is sometimes conspicuous. The configuration of the ornamentation is essentially the same at all growth stage and parallels the margin of the aperture. The suture is similar to that of the gaudryceratid-type in having a bifid first lateral saddle (Fig. 1-2).

Comparison: *Gabbioceras mikasaense* sp. nov. resembles *Gabbioceras beraketense* (COLLINGNON, 1964, pl. 318, figs. 1354, 1355) from the lower Cenomanian (*Mantelliceras martimpreyi* Zone) of Madagascar but is distinguished

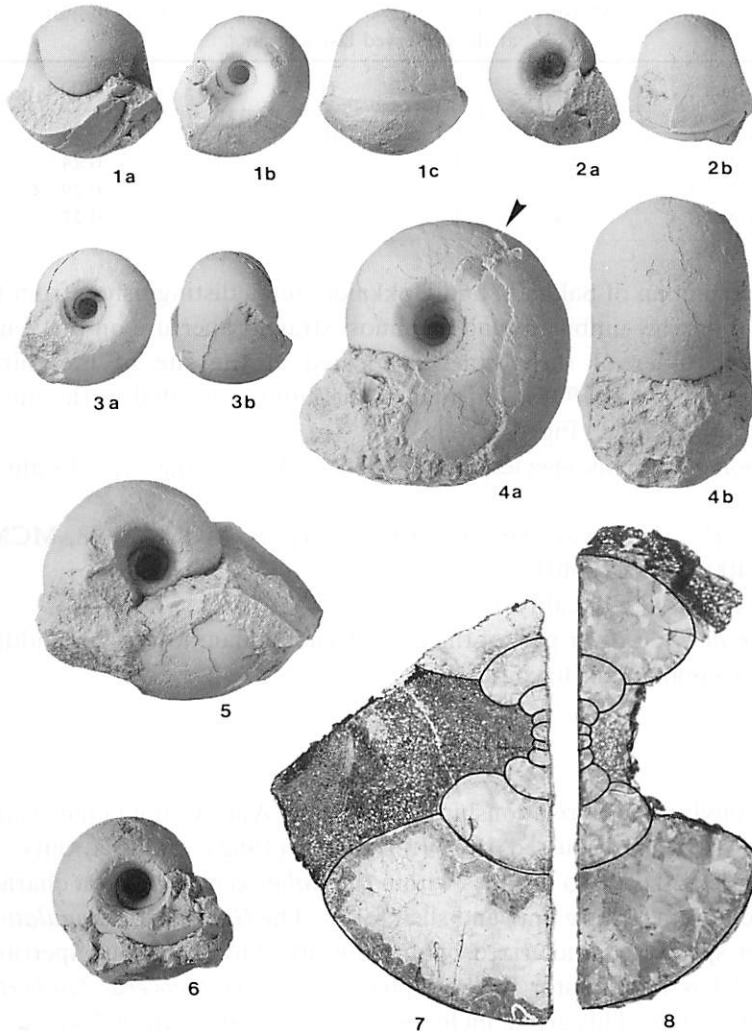


Fig. 2. 1, 2, 7, *Gabbioceras yezoense* sp. nov., 1a-c, paratype, NSM PM8299, locality 6, $\times 1.2$; 2a-b, holotype, NSM PM8300, locality 4, $\times 1.2$; 7, paratype, UMUT MM18958, cross sectional view, locality 5, $\times 4.8$; 3-6, 8, *Gabbioceras mikasaense* sp. nov., 3a-b, paratype, MCM. A399, locality 2, $\times 1.2$; 4a-b, holotype, MCM. A397, locality 1, $\times 1.2$, Arrow = position of the last septum; 5, paratype, MCM. A398, locality 3, $\times 1.2$; 6, paratype, MCM. A400, locality 3, $\times 1.2$; 8, paratype, MCM. A401, cross sectional view, locality 3, $\times 4.8$.

from the latter in having a fairly narrow umbilicus and a nearly vertical umbilical wall.

Gabbioceras mikasaense sp. nov. also closely resembles the juvenile form of *Parajaubertella kawakitana* MATSUMOTO (1943, p. 667, text-figure 2) from the

Table 2. Measurements (in mm) of *Gabbioceras mikasaense* sp. nov. at the preserved last septum.

Specimen	D	U	H	B	U/D	B/H
MCM A397	23.0	5.5	10.2	17.6	0.24	1.73
MCM A398	19.3	4.7	8.2	15.2	0.24	1.85
MCM A399	13.2	3.8	5.5	10.9	0.29	1.98
MCM A400	15.4	4.1	6.8	12.8	0.27	1.88

lower Cenomanian of Sakhalin and Hokkaido but is distinguished from the latter in having a narrow umbilicus and an almost straight aperture on the venter. The umbilical shoulder of the former is located at the site of the third saddle (MATSUMOTO, 1943, 1995), but that of the latter is located in the midst of the second umbilical lobe (Fig. 1-2).

Etymology: This species is named for Mikasa, the type locality of this species.

Material: Holotype, MCM. A397; paratypes, MCM. A398, MCM. A399, MCM. A400, MCM. A401.

Type locality: Locality 1.

Occurrence: Lower part of the lower Cenomanian; locality 2, middle part of the lower Cenomanian; localities 1, 3.

Discussion

The phylogenetic relationships within the Apto-Cenomanian *Gabbioceras* species have been discussed by WIEDMANN (1962) and MURPHY (1967b). MURPHY recognized two lineages within the *Gabbioceras* based on characteristics of ornamentation, suture line, and shell form. The *Gabbioceras angulatum* group consists of species characterized by an adorally convex sinuous aperture on the venter and has its ancestor in the Aptian species, *Gabbioceras lamberti* (BREISTROFFER), 1936. This group includes *Gabbioceras angulatum* ANDERSON, 1902 from the Aptian and *Gabbioceras jacobi* MURPHY, 1967 from the lower Albian. The *Gabbioceras michelianum* group consists of species characterized by an almost straight aperture on the venter. *Gabbioceras lamberti* (BREISTROFFER), 1936 of the former group seems to be a possible ancestor of this group, and this group includes *Gabbioceras drushtchici* WIEDMANN, 1962, *Gabbioceras muntaneri* WIEDMANN, 1962, and *Gabbioceras michelianum* (d'ORBIGNY), 1850 from the Albian and *Gabbioceras beraketense* (COLLINGNON), 1964 from the lower Cenomanian.

Gabbioceras yezoense sp. nov. possesses an almost straight aperture on the venter, and it belongs to the *Gabbioceras michelianum* group. Furthermore, this species closely resembles *Gabbioceras michelianum* (d'ORBIGNY) in having a very

depressed whorl and funnel-shaped deep umbilicus. Therefore, *Gabbioceras yezoense* sp. nov. is considered to have originated from a species of this group, and the probable ancestor is *Gabbioceras michelianum* (d'ORBIGNY), 1850. *Gabbioceras mikasaense* sp. nov., with the same apertural type, may also have been derived from a species of this group. Judging from the morphological similarity and stratigraphical distribution, the probable ancestor of *Gabbioceras mikasaense* sp. nov. is either *Gabbioceras yezoense* sp. nov. or *Gabbioceras beraketense* (COLLIGNON), 1964.

According to MURPHY(1967), *Gabbioceras* evolved and radiated in the Tethyan realm during the Aptian and Albian, and, thereafter, declined in diversity in the Cenomanian. Only one endemic species of Cenomanian *Gabbioceras* is known from the lower Cenomanian of Madagascar. However, there were two Cenomanian species of the genus, at least in Japan, as described above. This evidence shows that *Gabbioceras* evolved in the Northwest Pacific region and Madagascar during the early Cenomanian.

Gaudryceratid ammonites in the lower Cenomanian of Hokkaido are more diverse and abundant than below and more than ten species have been described (MATSUMOTO *et al.*, 1972; MATSUMOTO, 1984, 1995; this paper). Most of them are endemic species restricted to the region of Hokkaido and Sakhalin. Especially, *Takahashia* MATSUMOTO, 1984 and *Miogaudryceras* MATSUMOTO, 1995 are endemic genera in the lower Cenomanian of Hokkaido. This evidence shows that a phylogenetic divergence and endemism of gaudryceratid ammonites occurred at about the age of the Albian-Cenomanian transition.

Acknowledgements

I wish to thank Emeritus Professor Tatsuro MATSUMOTO, Kyushu University, Professor Kazushige TANABE, University of Tokyo, Dr. Neil H. LANDMAN, American Museum of Natural History, Dr. Tomoki KASE, National Science Museum, for critical reading of the manuscript. I am much indebted to Dr. Haruyoshi MAEDA, Kyoto University, Messrs. Shigehiro UCHIDA and Toshihiro SAKAI for providing specimens. I am also grateful to Messrs. Toshiya MIYAUCHI, Taichi IWASA and Koji HASEGAWA, for their help in the field work. This study was supported by Fujiwara Natural History Foundation.

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Appendix

Locality Information

The following localities are entered in the National Science Museum, Paleontological Collection Locality (NSM PCL).

Locality 1 [NSM PCL 4–14–14; 141°58'32''E, 43°14'02''N; =locality IK1236 in UCHIDA (1995)]; a roadside cliff about 3 km south of at Ikushumbetsu, Mikasa

City, Hokkaido; the lower part of Member 2b of the Mikasa Formation in MATSUMOTO (1965); silty sandstone; the middle part of the lower Cenomanian (*Mantelliceras japonicum* Zone) by MATSUMOTO (1991).

Locality 2 [NSM PCL 4-14-13; 141°58'30''E, 43°14'04''N;=locality IK1235 in UCHIDA (1995)]; a roadside cliff near locality 1 about 3 km south of at Ikushumbetsu, Mikasa City, Hokkaido; Member 2a of the Mikasa Formation in MATSUMOTO (1965); sandy siltstone; the lower part of the lower Cenomanian (*Desmoceras kossmati-Graysonites adkinsi* Zone) by MATSUMOTO (1991).

Locality 3 [NSM PCL 4-15-1; 142°0'02''E, 43°14'34''N;=locality IK1100 in MATSUMOTO (1965)]; a cliff above a shelter covering the prefectural road from Ikushumbetsu to the Katsurazawa dam, Mikasa City, Hokkaido; the lower part of Member 2b of the Mikasa Formation in MATSUMOTO (1965); silty sandstone; the middle part of the lower Cenomanian (*Mantelliceras japonicum* Zone) by MATSUMOTO (1991).

Locality 4 [NSM PCL 3-35-4; 142°5'46''E, 44°16'49''N]; calcareous concretion in the stream bed of Shumarinai-gawa River, Horokanai-cho, Hokkaido; Middle Yezo Group; the lower part of the lower Cenomanian (*Desmoceras kossmati-Graysonites adkinsi* Zone) by MATSUMOTO (1991).

Locality 5 [NSM PCL 3-35-3; 142°4'52''E, 44°13'00''N]; calcareous concretion in the stream bed of Suribachi-zawa Creek, a tributary of the Sounnai River, Horokanai-cho, Hokkaido; Middle Yezo Group; the lower part of the lower Cenomanian (*Desmoceras kossmati-Graysonites adkinsi* Zone) by MATSUMOTO (1991).

Locality 6 [NSM PCL 3-4-5-4; 142°1'48''E, 45°25'56''N]; calcareous concretion was obtained from the coast near the fishery harbor of Higashiura, Wakkanai City, Hokkaido; Middle Yezo Group; the lower part of the lower Cenomanian (*Desmoceras kossmati-Graysonites adkinsi* Zone) by MATSUMOTO (1991).